

A METHOD AND SYSTEM TO FACILITATE
REPORTING RESULTS OF A DEFECT INSPECTION

5

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional application Serial No. 60/395,252 filed July 12, 2002.

10

BACKGROUND OF THE INVENTION

1. Field of the Invention

15

The present invention relates to methods and systems to facilitate reporting results of a defect inspection. In particular, the present invention relate to such methods and system which utilize a portable computer to facilitate the reporting.

20

2. Background Art

25

Automobiles, kitchen appliances, and other products include multiple body portions. The body portions are the outwardly visible portions of the product. For example, the multiple body portions of a vehicle include a hood, a roof, a truck, a front quarter panel, a rear corner panel, and a door.

30

The appearance of the product is affected by the appearance of the body portions. Defects can negatively affect the appearance. Common defects include foreign contaminant defects, paint defects, rust defects, weld defects, structural defects, such as dents and scratches, and others. The customer prefers the product to be defect

free. Accordingly, there exists a need to inspect the multiple body portions for defects.

In the past, the body portions were inspected in a paper reporting process. The paper reporting process generally comprised inspecting each body portion and recording defects on a piece of paper. The inspector files the paper indicating the defects in a filing cabinet for later use. When needed, the inspector retrieves the defect papers to analyze the manufacturing process.

The appearance of the body portions is critical to customers satisfaction. The paper reporting process can makes analysis of the body portions a time consumer process. Because the defect data is recorded on a piece of paper, the inspector must manually perform a number of time consuming tasks to make use of the manually recorded defect data. Accordingly, there exists a need to report defects in a less time consuming manner.

SUMMARY OF THE INVENTION

The present invention relates to an invention to facilitate reporting results of a defect inspection. The defect inspection can relate to paint defects, structural defects, dimensional defects, and other defects. The present invention is suited to products having multiple body portions. The multiple body portions are displayed to an inspector to facilitate reporting defects. In this manner, the needs identified above are addressed with the present invention.

One aspect of the present invention relates to a portable computer. The portable computer is preferably a hand-held personal digital assistant. The portable computer includes a screen an inspector can view. The screen permits

the inspector to view a graphically user interface. The graphical user interface graphically displays multiple body portions of the product and each body portion is selectable so that the displayed body portions correspond with the 5 inspected product.

The portable computer includes a receiver to receive a defect input from the inspector. The defect input indicates a defect in one or more of the displayed body portions. The screen can be a touch screen. The inspector 10 clicks on the touch screen to indicate which one or more of the displayed body portions has the defect. The receiver can also be an audible unit for receiving voice commands from the inspector. The audible unit allows the inspector to call out which one or more of the displayed body portions 15 has the defect.

The portable computer includes a processing means to generate defect data. The defect data represents which body portion has the defect. The processing means can include defect description data with the defect data. The 20 graphical user interface can provide a defect description menu for use by the inspector to select a defect description. The defect description is processed by the processing means to become part of the defect data. In addition, the graphical user interface can operate in conjunction with the touch screen to provide a comment field 25 wherein the inspector can electronically write comments. Likewise, the audible unit can convert voice commands to similar comments. The processing means includes the written and audible comments with the defect data.

30 One aspect of the present invention relates to a system to facilitate reporting results of a defect inspection. The system comprises a computer and the portable computer described above. The portable computer

stores the defect data for transfer to the computer. The computer receives the defect data and provides processing of the defect data to facilitate analyzing the defects.

The computer provides a number of weekly tasks to facilitate analyzing the defect data on a weekly basis. The number of weekly tasks require an inspector to execute each task to receive a check mark. A check mark is received to indicate completion of the task such that a supervisor can review the check mark to determine whether the inspector is analyzing the defect data on a regular basis. In addition, the computer can automatically provide predefined defect charts to further facilitate analyzing the defect data. One of the weekly tasks can include analyzing the predefined defect charts in order to receive a check mark for that portion of the weekly task.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a system to facilitate reporting results of a defect inspection;

Figure 2 illustrates a first screen display of a portable computer used to facilitate reporting results of a defect inspection;

Figure 3 illustrates a second screen display of the portable computer;

Figure 4 illustrates a third screen display of the portable computer;

Figure 5 illustrates a fourth screen display of the portable computer;

Figure 6 illustrates a fifth screen display of a computer used to facilitate reporting results of a defect inspection;

Figure 7 illustrates a seventh screen display of the computer;

Figure 8 illustrates a top coat booth 1 control chart generated by the computer;

5 Figure 9 illustrates a dirt overlay chart generated by the computer; and

Figure 10 illustrates a customized chart generation display for use with the computer.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Figure 1 illustrates a system 10 in accordance with the present invention. The system 10 comprises a portable computer 12, a computer 14, and a product 16. The 15 system 10 facilitates reporting results of an inspection of the product 16.

The product 16 shown is an automobile. The automobile includes multiple body portions, including a front quarter portion 20, a front door portion 22, a rear door portion 24, a rear quarter portion 26, a hood portion 28, a roof portion 30, and a trunk portion 32. The reporting of a defect in the multiple body portions is facilitated by the system 10.

The reported defects can include foreign 25 contaminant defects, paint defects, rust defects, weld defects, structural defects, such as dents and scratches, and others. The present description relates to the utilization of the system with respect to facilitating the reporting of a defect inspection of the product being an 30 automobile.

The description is not intended to limit the present invention to automobiles. Rather, the system can be used to facilitate reporting the results of defect

inspections of other products. The other products can include appliances - such as washing machines, refrigerators, dryers, dishwashers - and vehicles - such as boats, planes, campers, helicopters, buses - and any other 5 item which includes multiple body portions. Preferably, the multiple body portions are viewable by the inspector and the customer.

The system can further comprise a network 38 and a database 40. The network 38 facilitates the communication 10 between the portable computer 12 and the computer 14. The network 38 is optional, and in its absence, the portable computer 12 can communicate directly with the computer 14 through a docking procedure or a wireless procedure. The database 40 maintains data received by the computer 14. 15 Data can be added to and removed from the database 40 to analyze the results of various defect inspections.

Preferably, the defect inspections occur with respect to the painting portion of an automobile manufacturing process. In this manner, the computer 14 and 20 the database 40 can be used to store data to facilitate analysis of the manufacturing process. The portable computer 12 preferably is a hand-held personal digital assistant. The portability of the portable computer 12 allows the inspector to walk through an assembly plant to 25 inspect the vehicle 16 at different stages in the manufacturing process. The inspector can inspect a number of vehicles 16 and then return to the computer 14 to use the portable computer 12 to report the results of the defect inspection.

30 Figure 2 illustrates a first screen display 44 of the portable computer 12. The screen display 44 is viewable by a screen 46 of the portable computer 12. The portable computer 12 is programmed with a graphical user interface to

generate the screen display 44. The graphical user interface is a tool the inspector can use to facilitate the reporting of the results of the defect inspection. The portable computer 12 preferably includes a processing means 5 to support the graphical user interface.

The graphical user interface shown in Figure 2 illustrates the first screen display 44. The first screen display 44 generally relates to product selection. The first screen display 44 provides a vehicle year menu 48, 10 vehicle model menu 50, and a vehicle paint color menu 52. The parameters of the vehicle to be inspected are selected from the menus.

The inspector can make the selections with a pointing device or voice commands. The screen 46 can be a 15 touch screen to permit the inspector to click on the menus to make the selection. Alternatively, the portable computer can include an audible device 48 for receiving voice commands from the inspection. The processing means interprets the voice commands and selects the criterion from 20 the menu as if the pointing device was used to click on a touch screen. The portable computer 12 can also include a hybrid configuration which can make use of the touch screen functionality and the voice command functionality.

A circle acts like the enter button entering the 25 data for that screen. A house button 56 is a home link taking the inspector back to the first screen display 44 of Figure 2. A X button 58 deletes the information for that screen.

Figure 3 illustrates a second screen display 60 30 which appears with selection of the circle button. The second screen display 60 generally relates to displaying multiple body portions of the vehicle selected in Figure 2. In Figure 3, the criterion corresponding with a vehicle

model year of 2003, a vehicle type of LS, and a paint color of DV-Light Tundra" is displayed. A corresponding vehicle body display 61 includes the multiple body portions comprising the selected vehicle.

5 The multiple body portions include a first-side front quarter portion 62, a first-side front door portion 64, a first-side rear door portion 66, a first-side rear quarter portion 68, a hood portion 70, a roof portion 72, a trunk portion 74, a second-side front quarter portion 76, a 10 second-side front door portion 78, a second-side rear door portion 80, and a second-side rear quarter portion 82. The inspector can click on each one of the multiple body portions to indicate a defect.

15 Figure 4 illustrates a third screen display 90. The third screen display 90 generally relates to inputting a defect. More specifically, the third screen display 90 relates to inputting a defect for the first-side rear quarter portion 68. The inspector clicks on the first-side rear quarter portion 68 in Figure 3 to display the portion 20 shown in Figure 4.

15 The third screen display 90 divides the first-side rear quarter portion into a number of small portions, which are referred with reference numerals 92, 94, 96, 98, 100, 102, 104, 106, and 108. The inspector clicks on the smaller portion corresponding with the defect. The clicked on smaller portion produces a defect input 112. As shown, portion 112 was clicked on to indicate a defect. In response, the processing means generates defect data for the defect input. The defect data represents which body portion 30 has the defect.

15 A paint defect description menu 114 and a paint layer menu 116 are provided. The inspector selects a paint defect description from the paint defect description menu

114 and a paint layer from the paint layer menu 116 after
clicking on portion 112. The processing means includes the
selected paint defect description and the selected paint
layer with the defect data. This information is associated
5 with the defect for subsequent analysis and reporting.

The inspector can click on another portion of the
first-side rear quarter portion shown in Figure 4 to add
additional defects. The menus reset with each click on one
of the body portions so that the new defect can be entered.
10 The third screen is exited when all defects are reported for
the first-side rear quarter portion. To exit, the inspector
clicks on a return button 120. The second screen display 60
is returned to in response to clicking on the return button
120.

15 A comment link 122 allows the inspector to add
additional defect description. The additional defect
description is included with the defect data. The comment
link can be actuated by the pointing device or a voice
command. A comment field appears with actuation in which
20 the inspector can use the pointer device to write on the
touch screen or dictate comments by way of the audible unit.
An image link 124 allows the inspector to note that an image
(photo) has been captured for the defect.

25 Figure 5 illustrates a fourth screen display 128.
The fourth screen display 128 indicates the total number of
defects reported for the first-side rear corner portion 60.
The fourth screen display appears once the inspector has
finished inspecting a vehicle and selects the return button
120. As shown, only one defect was entered. The inspector
30 can input additional defects by selecting one of the other
body portions shown in Figure 5. The above process is
repeated for each body portion as necessary. The fourth

screen display keeps a running total of the inputted defects.

The inspector exits the fourth screen display 128 and returns to the first screen display 44 by selecting the 5 house button 56. At this point, the inspector can select the criterion for the next vehicle to be inspected. Optionally, and not shown in the Figures, an additional display can be provided by the graphical user interface. The additional display can be used to facilitate tracking 10 the different vehicles being inspected.

The additional screen display is not always necessary because the defect data includes the defect descriptions. As such, the computer can be used to coordinate the reported defects. Moreover, each reported 15 defect includes the vehicle model year, the vehicle model, the vehicle color, the paint defect description, and the defective paint layer as part of the defect data. The computer can use the defect data to separately track the different vehicles. Typically, the individual vehicles need 20 not be identified at all as the defective vehicles are returned for repairs or other service. The computer primarily tracks the defect data according to the type of vehicle inspected and the number units (vehicles) inspected.

Returning to Figure 1, the system 10 includes the 25 computer 14. The computer 14 can receive the defect data, generated as shown in Figures 2-4, from the portable computer 12 and store the defect data in the database 40. In this manner, the portable computer 12 facilitates reporting the results of the defect inspection to the 30 computer 14. The computer 14 is also programmed to provide a graphical user interface to facilitate analysis of the reported defect inspection results. The computer 14 is preferably accessible by a number of inspectors in different

assembly plants to facilitate the sharing of reported defect results.

The portable computer 12 facilitates the inspection and the reporting of the inspection results at 5 each paint layer operation. In this manner, the inspector can inspect any number of vehicles at any point of the manufacturing process. The inspector may inspect a first vehicle after scuffing prior to adding the prime layer and then move on to inspecting a second and third vehicle after 10 adding the second top-coat, and then move one to other vehicles in any desired order. For each inspected vehicle, the inspector selects the criterion for as shown in Figure 2. The inspector completes a round of inspections and then transfers the defect data to the computer, as described 15 above.

Figure 6 a fifth screen display 136 for use with the computer 14. The fifth screen display 136 facilitates analysis of the reported defects in accordance with the present invention. The analysis preferably includes monthly 20 tasks 138, daily tasks 140, and reference material 142. The analysis forces inspectors to achieve a check mark 144 in each event listed for each task. Preferably, the data accessible through Figure 6 corresponds with a single assembly plant. The inspector can then report defects on a 25 plant by plant basis. The data from each plant can then form an overall report.

Each task and the reference material are accessible through hyperlinks. The hyperlinks are indicated with the underlined portions in each Figure. Each hyperlink 30 provides additional information. Check marks are received by the computer registering an inspector as having accessed the hyperlink. Optionally, the inspector may be required to actuate a submit button or take other confirmatory action

once the hyperlinks has been accessed in order to receive a check mark. Preferably, the fifth screen display 136 is a web page which can be navigated through by clicking on the provided hyperlinks.

5 One aspect of the monthly tasks 138 is a voice of the customer task. The voice of the customer task requires the inspector to review a received customer report in order to receive a check mark. The customer report provides customer defect input to the inspector. In this manner, the
10 inspector can review the defects which are apparent to the customer. The inspector can then make adjustments to the manufacturing process to limit the defects that are important to the customer. The adjustments can improve customer satisfaction. Moreover, tracking and reacting to
15 the voice of the customer can help ameliorate warranty issues as warranty issues are typically reported by a customer's vehicle.

20 Table #1 shown below exemplifies the type of information that may be available by accessing the voice of the customer task hyperlink.

CONCERN	2001 MODEL YEAR												2000 YTD
	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	Jan-01	Feb-01	Mar-01	Apr-01	May-01	2001 YTD	2000 YTD	
SATISFACTION	85%	85%	84%	82%	82%	83%	82%	86%	84%	87%	84%	85%	
PAINT SHOP RESPONSIBLE:													
Peeled Paint	1	7	6	4	5	6	12	3	9	7	5	5	
Faded/Dull Paint	4	4	5	6	6	3	9	11	6	2	5	6	
Sags/Runs in Paint	7	5	5	7	11	12	7	7	11	13	7	8	
Thin/No Paint	3	8	4	2	9	5	18	6	7	10	6	8	
Stained/Spotted Paint	7	6	7	6	15	3	18	5	16	47	8	10	
Dirt in Paint	4	9	5	8	5	7	8	8	11	15	6	10	
Uneven Color/Color Diff.	3	2	4	1	9	1	5	2	1	5	3	3	
Between Panels													
Paint Spray Over Body Panel	1	1	2	4	2	8	3	1	3	8	2	3	
PAINT SHOP SUB TOTAL	30	42	38	38	62	45	80	43	64	107	42	53	
Body Rust	2	5	4	1	1	4	0	1	0	26	3	2	
Detail Paint	6	4	5	4	1	6	0	3	10	5	4	4	
Other Exterior Paint Troubles	6	7	9	7	6	11	14	13	5	39	8	9	
PAINT LESS CHIP/SCRATCHED	44	58	56	50	70	66	94	60	79	177	57	68	
Chipped Paint	16	29	34	32	44	38	36	37	32	60	31	37	
Scratched Paint	26	41	42	48	42	47	50	41	67	20	42	46	
CHIP AND SCRATCH TOTAL	42	70	76	80	86	85	86	78	99	80	73	83	
TOTAL PAINT CONCERNs	85	127	130	131	155	153	179	137	178	257	132	151	

TABLE #1

Table #1 could also be graphically displayed according to any number of other criterion. Preferably, each vehicle type to be inspected by the inspector is accessible.

5 One aspect of the monthly tasks is a vehicle response team (VRT) task. The vehicle response team task requires the inspector to form teams dedicated to specific areas of the manufacturing process. Preferably, the teams are charged with improving quality and cost. The vehicle
10 response team check is received when a vehicle response team report has been written and presented to management. The section will provide tool to build team report-out documentation based on the defect data and actions. Table #2 shown below exemplifies the type of information that may
15 be available by accessing the VRT review task hyperlink.

Area of Manufacturing Process	Team Members
Painting	XX, XXY, and XXX

TABLE #2

20 One aspect of the weekly tasks is a internal quality indicators task. The task requests the inspector to collect and optionally store defect data gathered by other inspection processes. Preferably, the defect data is gathered according to internal inspection points. In
25 addition, the task provides data on internal customers and is also used to decide where to spend time on fixing defects. In some cases, a pareto chart is included. The internal quality indicators check is received if the inspector accesses the hyperlink and analyzes the internal
30 data as it relates to the task at hand.

One aspect of the weekly tasks is a data collection task. The data collection task relates to the collection and reporting of results of the detailed defect inspection.

5 Figure 7 illustrates a seventh screen 146 which appears if a charting/analysis hyperlink is accessed. The tasks includes a number of daily analysis tasks 148 and weekly analysis tasks 150.

10 The daily analysis task 148 each should received a check mark on a daily basis. The daily tasks generally relate to the inspector inspecting a number of defect charts automatically generated for the inspected vehicles. The tasks shown in Figure 7 relate to inspecting the painting portion of the manufacturing process. The present invention 15 is not limited to the only inspecting the painting portion of the manufacturing process, however.

20 In general, the painting portion of a vehicle manufacturing process comprises applying a number of paint layers to the vehicle. The paint layers include an e-coat layer, scuffing prior to adding a primer layer, adding the primer layer, scuffing the added primer layer, adding a first top-coat in a first booth (base coat), adding a second top-coat in a second booth (clear coat). The final product 25 is inspected and polished before sending to the next assembly process.

30 It is desirable to inspect the paint layer after each paint layer operation. Moreover, it is desirable to monitor the defect inspection results for each paint layer operation. As such defect charts are provided. The defect charts include a e-coat before scuff chart, a prime before scuff chart, a prime after scuff chart, a top coat all booths chart, a top coat booth 1 char, a top coat booth 2

char, a after polish control chart, a dirt by layer pareto, and dirt by body portion.

Figure 8 illustrates a top coat booth 1 control chart 154. The chart includes a daily average of defects relative to the top coat layer in booth 1. The chart allows the inspect to analyze the process for the top coat layer in booth 1 over time. A yearly chart 156, a monthly chart 158, a weekly chart 160, and a daily chart 162 are provided to facilitate the analysis. The charts allow an inspect to analyze the painting process at each assembly plant.

Figure 8 also provides a note field 164 for the inspector to input additional comments. The notes can be requests for process controls and analysis or other commands. In this manner, the inspector can open action items for further investigations. For example, the weekly chart may indicate an increase in defects. In response, the inspector may kick off additional inspects by adding a note and submitting it for analysis with a submit analysis button.

Each marker 166 on the charts corresponds with an average defect count for the time period (daily, weekly etc.). Rolling over the marker brings up additional defect data regarding the particular defect. Table #3 shown below indicates some of the information available for a marker. Similar information is available for the non-daily markers on a average basis.

Update the Notes for the Sub Task	
Paint Shop Code	WIX
Shift	2
Average	5
Units	1
Total Dirt Count	5
Date	5/27/2003
Notes:	Feather Duster not working properly

TABLE #3

Similar charts are available for each hyperlink
 5 shown in Figure 8. The pareto charts present additional information in pareto form. Unlike the non-pareto charts, the pareto charts include defect data from other paint layer operations. This provides for a side-by-side analysis of the paint layers, rather than requiring the inspector to
 10 review each chart separately. This can be advantageous as the inspector may not appreciate the defect data due to an inability to review the side-by-side data in the other charts.

Each daily task receives a check mark when the
 15 inspector accesses the link and clicks on the submit analysis button. This forces the inspector to access each chart prior to receiving check marks. Preferably, the inspector is monitored by a supervising inspector. The supervising inspector can be in charge of monitor the
 20 painting process at a number of assembly plants. The computer is remotely accessible to provide such functionality. The supervising inspector can than monitor each plant inspector to insure the best analysis.

The weekly tasks receive check marks in a similar
 25 fashion. A dirt defect type by layer pareto link provides

access to a pareto chart of all the defects at a plant for each paint layer. This chart shows the four layers in pareto format and the number of defects found in each layer. This helps the inspector determine where in the process to focus attention on defect reduction efforts.

Figure 9 illustrates a dirt overlay chart 170. The dirt overlay task forces the inspector to review a display having all the body portions of a selected vehicle. The display includes the total number of defects inputted for the vehicle. This is yet another means to insure the inspector is reviewing the defect data. Each displayed body portion can then be accessed to provide further detail. Preferably, clicking on the body portion brings up the further detail.

Figure 10 is an additional aspect of charting/analysis. Figure 10 is accessed by accessing an ad hoc reporting link 172. A selection screen 174 includes a number of criterion for generating a chart. The chart is then analyzed by the inspector. The selection screen includes fields for a start date, an end date, a plant location, a vehicle model year, a vehicle color, a vehicle body portion, a paint layer, a vehicle model, and a defect type.

Preferably, the inspector has instructions to analyze different combinations of criterion or the inspector can determine a set of criterion to analyze. For example, the inspector may receive a warranty notification. The warranty notification may necessitate going back in time to determine what defect data was reported. The inspector can enter the dates to facilitate charting and then analyzing the charted data. This can help the inspector solve the warranty issue. Likewise, the inspector may desire to check different charts periodically. Any combination of criterion

can be selected for generating charts and analyzing the generated charts.

Returning to Figure 6, one aspect of the daily tasks is a defect actions task. The defect actions task relates to quality control. The defect action task hyperlink accesses the information contained below in Table #4.

Base-Coat

#	Concern (D2)	Criteria	Responsible (D1)	A	Containment Action (D3)	Open Date	Root Cause (D4)	Permanent Action (D5)	Close Date	Attachments	Verification	% Impr.
12	Basecoat Splits (primarily left side)	<u>Layer:</u> Base- Coat <u>Loc:</u> Top Coat B.2 <u>D/Type:</u> B/C Split	Terry Manns <u>Nolan.Ely</u>	1	Sand/Polish/repaint	05/30/2003	=	=	=	Add/View	=	=

Clear-Coat

#	Concern (D2)	Criteria	Responsible (D1)	A	Containment Action (D3)	Open Date	Root Cause (D4)	Permanent Action (D5)	Close Date	Attachments	Verification	% Impr.
11	Carbon Appearing as dirt in the Clear Coat	<u>Layer:</u> Clear Coat <u>Loc:</u> Top Coat B.1 <u>D/Type:</u> Unknown	Terry Manns <u>Nolan.Ely</u>	= 100% - inspection/spillout - polish, spot or repaint	06/15/2002	High temp filter allowing carbon to enter Enamel oven #3 z	Replaced Hi-temp filters in Enamel #1 zone 3	06/15/2002	Add/View	FAT 50 FTT 85%	FAT 30 FTT 90%	=

TABLE #4

Table #4 includes a number of concerns. The concerns relate to defects or potential defects. Each concern includes a containment action. The containment action describes what should be done to limit to occurrences of the defect. The inspector is forced to continually review and update the form in order to receive a defect actions check mark. In this manner, the inspector's attention is focused on correction of the defect.

Table #4 includes a criteria section, a responsibility section, an open date section, a root cause section, a close date section, an attachment section, a verification section and a percent improved section. The "action task" is a problem solving tool that leads people through the process from containment to permanent resolution. Not shown in the table are the action buttons where a new action can be added, search capability and print capability. Clicking the hyperlink portion in any column will take you to a screen where you can modify or add information.

Concern (02) is a description of the concern being worked on. Criteria shows what the defect is and in which layer and inspection location it was found. Responsible indicates the team members responsible to take the lead on fixing this issue. "A" indicates if there are any assignments related to this issue. Clicking on this will take you to an assignment application where details of the assignment are visible. Containment identifies the actions being taken to keep the issue from progressing through the process while a permanent solution is under investigation. Root Cause identifies what the root cause of the issue is (when found). Permanent Action describes what actions were taken that eliminated the problem and the need for containment actions. Attachments provide a place for

the team to attach items such as photos or reports that help the team in problem resolution and knowledge retention for the future. Verification provides a method to record before and after numbers that relate to the quality of the issue so 5 that progress can be measured and determine when problem is solved. % Impr is a calculation on the before and after verification numbers to determine percent improvement

Returning to Figure 6, reference material is provided. The reference material is accessed through 10 hyperlinks. The reference material permits the inspectors at each plant to build a knowledge base that can be shared with inspectors from other plants. The knowledge base can help facilitate problem solving.

One reference material relates to a dirt team. 15 The dirt team indicates member responsible for one or more of inspecting vehicle, repairing defective vehicle, and analyzing the reported defects. Contact information for each dirt team member is available, as shown below in Table #5. The contact information is beneficial to facilitate 20 reaching dirt team members from other plants. In some cases, it may be beneficial to contact a member in another plant to discuss a solution to a defect.

NAME	PHONE NUMBER	E-MAIL	PLANT LOCATION

25

TABLE #5

One reference material relates to a defect library. The defect library provides images of known defects. The defect library can include images of paint

defects, foreign contaminant defects, rust defects, weld defects, structural defects such as dents and scratches, and others. The inspector can access the image to assist with identifying defects. The inspector can also add images to 5 the defect library. The added defect images can alert other inspectors to new types of defects.

One reference material relates to an reaction/containment plan. The reaction/containment plan is shown below in Table #6. The reaction/containment plan 10 generally relates to a problem solving tool. The concept is to take major or frequently re-occurring issues and distil the important data into a searchable matrix for the plant floor people to use if a problem happens again at a later date. For example, if the inspector sees that there is 15 carbon in the clearcoat layer, the inspector can reference the reaction/containment plan process to identify the steps to contain the issue and begin the process to fix the problem. It is a tool to tell people what to do to contain and resolve issues that have been fixed before. However, if 20 the known fixes do not solve the problem, a new problem should be opened and the solutions identified from the new problem will be added to the list of potential solutions in the containment/reaction plan.

Plant Shop: Wixom					
Containment Information			Search Retrieved -1- rows		
Item No.	Last Updated	Issue/Concern	Location (Escape Point D4)	Reaction/Containment Action Statement	Detailed Action Description Including Personnel & Materials Required
1	05/30/03	Carbon in the Clear	=	Sand/polish/repaint	5/30/03 Typical root cause is dirty combustion ...

25

TABLE #6

One reference material relates to a control plan. The Control Plan identifies the minimum requirements in data gathering and analysis charting to maintain the knowledge about the process being monitored. This will provide a 5 statistically significant amount of data on which decisions can be made, making sure that the team is focused on significant events and not random noise. The control plan is shown below in Table #7.

End Item and Customer Spillout		Paint Engineering/WAP										12-May-03		Wixom Specific Control Plan	
Matrix No.	Process Name	Machine Device Tools for Manufacturing	PLANT Wixom Assembly Plant			Eng. Specification			Method	Frequency	Analysis Method	Reaction Plan			
			Process Parameters	Characteristic Product	Characteristic	Upper Units	Nominal	Lower							
1	Dirt	E-Coat	E-Coat Before Scuff	Dirt Count	U				Visual Inspection	5 units/ Daily/ Dispersed	Trend & Pareto				
8	Prime	Prime Before Scuff	Prime Before Scuff	Dirt Count	U				Visual Inspection	5 units/ Daily/ Dispersed	Trend & Pareto				
9	Prime	Prime After Scuff	Prime After Scuff	Dirt Count	U				Visual Inspection	5 units/ Daily/ Dispersed	Trend & Pareto				
10	#1 Color Booth	Booth #1 Before Polish	Booth #1 Before Polish	Dirt Count	U				Visual Inspection	10 units/ Daily/ Dispersed	Trend & Pareto				
11	#2 Color Booth	Booth #2 Before Polish	Booth #2 Before Polish	Dirt Count	U				Visual Inspection	10 units/ Daily/ Dispersed	Trend & Pareto				
12	OK Line	After Polish	After Polish	Dirt Count	U				Visual Inspection	10 units/ Daily/ Dispersed	Trend & Pareto				
13	E-Coat	E-Coat Before Scuff	Analyzed Dirt	U					Visual Inspection	2 units/ Daily/ Dispersed	Trend & Pareto				
14	Prime	Prime Before Scuff	Analyzed Dirt	U					Visual Inspection	2 units/ Daily/ Dispersed	Trend & Pareto				
15	#1 Color Booth	Booth #1 Before Polish	Analyzed Dirt	U					Visual Inspection	3 units/ Daily/ Dispersed	Trend & Pareto				
16	#2 Color Booth	Booth #2 Before Polish	Analyzed Dirt	U					Visual Inspection	3 units/ Daily/ Dispersed	Trend & Pareto				

TABLE #7

One reference material relates to a maintenance plan. The maintenance actions is a tool that provides the team with a place to store re-occurring maintenance action that were found to solve previous defect problems. For 5 example, if the team solved a problem by identifying that a critical filter needed to be changed every 90 days to avoid a defect issue, that information would be entered into the maintenance action tool which would then remind the inspector to make sure that the required action really did 10 take place, and if not to make sure that it does. The maintenance plan is shown below in Table #8.

Wixom DiP Maintenance Actions						
#	Maintenance Required	Responsible	Frequency (in days)	Date Last Done	Reaction Plan #	Issue
1	Change booth filters	Booth cleaner	90 days	03/02/02	<u>Wix012</u>	Clogged filters contribute to dirt in paint on the hood
2	Clean feather duster	Vendor	120 days	3/2/02	<u>Wix032</u>	Dirty feathers adding more dirt than taking away

TABLE #8

15

While the best mode for carrying out the invention has been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the 20 invention as defined by the following claims.